Appendix B

Health Risk Assessment Methodology for Dry Cleaning Operations

Appendix B

Health Risk Assessment Methodology for Dry Cleaning Operations

A. Introduction

This appendix presents the methodology used to estimate the potential cancer and noncancer health impacts from exposure to Perc emitted during dry cleaning activities. Also included are results from the four meteorological data sets.

As discussed in Chapter IV, the assumptions used to determine the potential health impacts are based on a selection of generic modeling scenarios for routine dry cleaning operations throughout the state. The generic facilities were created from the evaluation of over 1,600 responses to a facility survey, information obtained during over 100 site visits, and input from draft industry-specific reports, industry representatives, and from Air Pollution Control or Air Quality Management Districts staff regarding dry cleaning operations. The generic release scenarios used in the HRA are presented in Section B of this appendix. This assessment uses meteorological data sets from four locations in California. Those locations are Anaheim, Fresno, Oakland (port), and San Diego (Miramar). Emissions, source release parameters, and modeling inputs are discussed in the sections which follow.

B. Emission Estimates

Emissions for the risk assessment were based on generic unit emission rates of 100 gallons per year (1,350 pounds per year) for annual emissions and 0.1 gallons per hour (1.35 pounds per hour) for hourly emissions. Since risk assessment results are based on generic emission rates, they can be easily adjusted to reflect any emission rate scenario. Tables B-3 to B-6 use the generic emission rates.

Table B-1 shows the average and high-end (90^{th} percentile) annual Perc emission rates that were used in Chapter IV of this report for dry cleaners with converted machines, primary controls, and secondary control. According to the facility survey results and our site visits, approximately 90 percent of dry cleaners emit below the high-end annual emission rate. The purpose for showing these two emission rates is to provide a perspective for Perc emissions at dry cleaning facilities in California. Hourly emissions are also shown for the three machines. The hourly emissions are based on the 10^{th} percentile of mileage and 90^{th} percentile for machine capacity from our survey results.

Table B-1. Emissions Rates

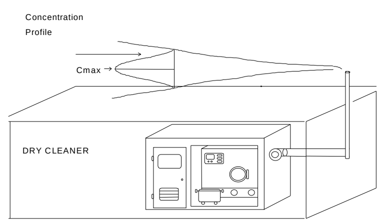
Scenario	Annual (gallons/year)		Hourly (gallons/hour)
	High-End Emissions [1]	Average Emissions	
Converted Machine	113	76	0.45
Primary Control	94	52	0.13
Secondary Control	61	34	0.06

1. High–end emissions are defined by the 90^{th} percentile of emissions.

C. Generic Dry Cleaner Configurations

Eight generic dry cleaner scenarios were used for the air dispersion modeling. The generic release scenarios used in the HRA are presented below in Figures (a) – (f).

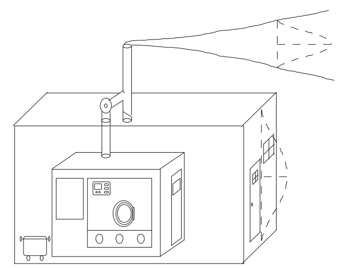
Figure (a) FULL VAPOR BARRIER ROOM (FVR)



For modeling purposes, assume: 100% capture by vapor barrier room (VBR), all emission modeled as point source.

POINT SOURCE:
Q = 1000 CFM; V = 15 m/s.
Stack Height = 5 feet + building ht. = 17 feet (5.18 m).
Diameter = 0.2 meters (8 inches).
Building Height = 12 feet.
Shop Size = Approximately 1100 ft^2.
Building Width = 10 meters (32.8 ft.).
Building Length = 10 meters (32.8 ft.).

Figure (b) PARTIAL VAPOR BARRIER ROOM (PVR)

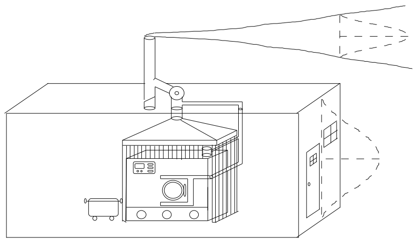


For modeling purposes, assume: 95% capture by PVR, 95% of emissions modeled as point source, 5% of emissions are treated as fugitive and modeled as volume source.

POINT SOURCE:
Q = 1000 CFM; V = 15 m/s.
Stack Height = 5 feet + building ht. = 17 feet (5.18 m).
Diameter = 0.2 meters (8 inches).
Building Height = 12 feet.
Shop Size = Approximately 1100 ft^2.
Building Width = 10 meters (32.8 ft.).
Building Length = 10 meters (32.8 ft.).

VOLUME SOURCE:
σ_{yo} = Length/4.3.
σ_{zo} = Height/ 2.15.
Building Height = 12 feet.
Release Ht = 0.5 Shop Ht = 6 feet.
Shop Size = Approximately 1100 ft^2.
Building Width = 10 meters (32.8 ft.).
Building Length = 10 meters (32.8 ft.).

Figure (c) LOCAL VENTILATION (L-VENT)

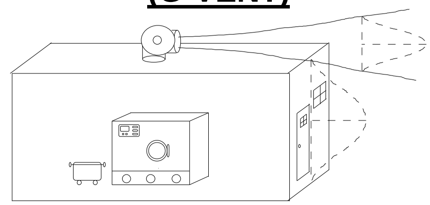


For modeling purposes, assume for typical system: 80% of emissions captured by fan and modeled as a point source, 20% of emissions are fugitive & modeled as volume source.

POINT SOURCE:
Q = 2500 CFM; V = 15 m/s.
Stack Height = 5 feet + building= 17 feet (5.18 m).
Diameter = 0.3 meters (12 inches).
Building Height = 12 feet.
Shop Size = Approximately 1100 ft^2.
Building Width = 10 meters (32.8 ft.).
Building Length = 10 meters (32.8 ft.).

VOLUME SOURCE:
σ_{yo} = Length/4.3.
σ_{zo} = Height/ 2.15.
Building Height = 12 feet.
Release Ht = 0.5 Shop Ht = 6 feet.
Shop Size = Approximately 1100 ft^2.
Building Width = 10 meters (32.8 ft.).
Building Length = 10 meters (32.8 ft.).

Figure (d) GENERAL VENTILATION (G-VENT)

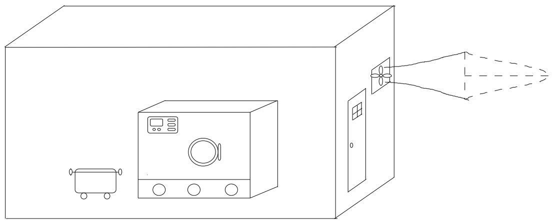


For modeling purposes, assume for typical system (< 1 change per 5 minutes): 60% capture of emissions by fan and modeled as horizontal point source, 40% of emissions are fugitive & modeled as volume source.

POINT SOURCE:
Q = 2500 CFM; V = 0.001 m/s (Exit velocity is 0.001 m/s and Q to 0.154 acfm to simulate horizontal flow, stack tip downwash off).
Stack Height = 1.5 feet + building= 13.5 feet (4.11 m).
Diameter = 0.3 meters (12 inches).
Building Height = 12 feet.
Shop Size = Approximately 1100 ft^2.
Building Width = 10 meters (32.8 ft.).
Building Length = 10 meters (32.8 ft.).
Scenario (B):
Stack Height = 1.5 feet + building= 19.5 feet (5.94 m).
Diameter = 0.3 meters (12 inches).
Building Height = 18 feet.
Shop Size = Approximately 2500 ft^2.
Building Width = 15 meters (49.2 ft.).
Building Length = 15 meters (49.2 ft.).

VOLUME SOURCE:
σ_{yo} = Length/4.3.
σ_{zo} = Height/ 2.15.
Building Height = 12 feet.
Release Ht = 0.5 Shop Ht = 6 feet.
Shop Size = Approximately 1100 ft^2.
Building Width = 10 meters (32.8 ft.).
Building Length = 10 meters (32.8 ft.).
Scenario (B):
Building Height = 18 feet.
Release Ht = 0.5 Shop Ht = 9 feet.
Shop Size = Approximately 2500 ft^2.
Building Width = 15 meters (49.2 ft.).
Building Length = 15 meters (49.2 ft.).

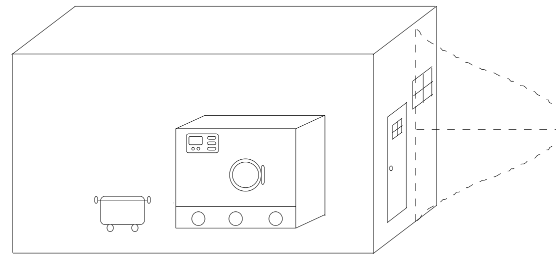
Figure (e) WINDOW FAN (WIN FAN)



For modeling purposes, assume: 100% of the emission are modeled as a horizontal point source.

POINT SOURCE:
Q = 5000 CFM, V = 0.001 m/s (Exit velocity is 0.001 m/s and Q to 0.154 acfm to simulate horizontal flow, stack tip downwash off).
Fan Height = 8 feet.
Diameter = 0.3 meters (12 inches).
Building Height = 12 feet.
Shop Size = Approximately 1100 ft^2.
Building Width = 10 meters (32.8 ft.).
Building Length = 10 meters (32.8 ft.).

Figure (f) NATURAL VENTILATION (N-VENT)



For modeling purposes, assume: 100% of emissions are fugitive & modeled as volume source.

VOLUME SOURCE:
σ_{yo} = Length/4.3.
σ_{zo} = Height/ 2.15.
Scenario A:
Building Height = 12 feet.
Release Ht = 0.5 Shop Ht = 6 feet.
Shop Size = Approximately 1100 ft^2.
Building Width = 10 meters (32.8 ft.).
Building Length = 10 meters (32.8 ft.).
Scenario (B):
Building Height = 18 feet.
Release Ht = 0.5 Shop Ht = 9 feet.
Shop Size = Approximately 2500 ft^2.
Building Width = 15 meters (49.2 ft.).
Building Length = 15 meters (49.2 ft.).

For all of the dry cleaner scenarios, stack releases are modeled as a point source and fugitive releases are modeled as a volume source. The dimensions of the volume source are assumed to be the size of the dry cleaning shop (not the size of the entire building). For those configurations with a stack that simulates the presence of a rain cap or which are vented horizontally, these facilities were modeled according to OEHHA and U.S. EPA guidance. In summary, that guidance states that stack gas exit velocity, gas temperature, and stack diameter are used to estimate plume rise based on the greater of thermal buoyancy or momentum. In the presence of a rain cap or horizontal vent, then the momentum plume rise is negated. Since a window fan and a general ventilation system do not have a vertical component to the exit velocity, the momentum component of plume rise equations should not be used. In addition, since the exhaust gas from the facility is near to ambient conditions, the thermal buoyancy portion of the plume rise equations should not be used either.

To simulate these conditions with a point source release with the ISCST3 air dispersion model, the exit velocity is set to 0.001 m/s (meters per second) and stack tip downwash is turned off, as recommended in *The Air Toxics Hot Spots Risk Assessment Guidelines; Part IV; Exposure Assessment and Stochastic Analysis Technical Support Document*, September 2000, (OEHHA, 2000b) and the U.S. EPA Model Clearinghouse Memo, July 9, 1993 (U.S. EPA, 1993). Also recommended in the guidelines is to reduce the stack height by three stack diameters (this is for the maximum stack-tip downwash effect). However, this would reduce the stack tip to a level below the roof-top, which is physically impossible. Therefore, the stack height is not adjusted.

C. Air Dispersion Modeling

The model that was used during this HRA was the Hot Spots Analysis and Reporting Program (HARP) (ARB, 2005h). HARP includes an air dispersion model, ISCST3. U.S. EPA recommends the ISCST3 model for refined air dispersion modeling (U.S. EPA, 1995). HARP is a recommended tool for risk analysis in California and can be used for most source types (e.g., point, area, and volume sources) and is currently used by the ARB, districts, and other states.

The eight generic dry cleaning scenarios and modeling inputs presented Section B were used for the risk assessment. This data was used in the air dispersion modeling analysis to estimate downwind concentrations. This assessment uses meteorological data sets from four locations in California. Those locations are Anaheim (81), Fresno (85-89), Oakland (port) (98-00), and San Diego (Miramar) (67-71). The year(s) of meteorological data used at each location are listed in the parenthesis. Eight-hour emission rate scalars were used when modeling the generic scenarios. All scenarios used urban dispersion, flat terrain, and building downwash.

D. Risk Assessment Results

Tables B-3 to B-6 provide an overview of the potential cancer risk between 20 and 400 meters for residential and (off-site) worker receptors exposed to the emissions of Perc from generic dry cleaners using secondary control. The potential health impacts are presented for generic facilities; therefore, the potential health impacts at an actual facility may vary due to that facility's individual characteristics. For any receptor located closer than 20 meters from a dry cleaner, it is possible that their potential health impacts may be either higher or lower than the results presented in this report. Factors that may contribute to this variation include meteorology (wind and weather) and the individual release characteristics at each facility. Currently, 20 meters is the minimum air dispersion modeling distance used by the ARB in their Air Toxics Program. Since 1997, the districts have used 20 meters as the minimum modeled distance in the industrywide risk assessment guidelines for sources in the Air Toxics Hot Spots Program. The impacts at the 100 meter distance is identified to provide perspective for the potential health impacts at 300 feet, which is distance listed in the regulation for siting criteria.

These tabulated results address each dry cleaner scenario presented in Section B and are broken down by meteorological data set. The risk estimates that are anticipated after implementation of the proposed amendments are footnoted with the number 6 in Tables B-3 to B-6 This footnote identifies the scenarios that use enhanced ventilation. Enhanced ventilation includes local ventilation, partial vapor barrier rooms, and full vapor barrier rooms. The results are presented assuming a unit emission rate of 1,350 pound per year (100 gallons per year). The results for residential receptors are presented using the high-end (393 L/kg-day), 80th percentile (302 L/kg-day), and average (271 L/kg-day) breathing rate point estimates under a 70-year exposure duration. The off-site worker scenario uses the worker breathing rate point estimate (149 L/kg-day) and a 40-year exposure duration. This risk assessment used the Tier 1 methodology outlined in the OEHHA Guidelines (OEHHA, 2003a). In conjunction with the OEHHA Guidelines, staff also followed the ARB's Interim Risk Management Policy (ARB, 2003a).

Each table shows the potential cancer risk to a distance of 400 meters. Potential cancer risks at distances beyond this point are no larger than one chance per million. Because the tables have spacing restraints, all scenario types are abbreviated. These abbreviations are defined in Table B-2.

Table B-2. Scenario Abbreviations for Tables B-3 to B-6

Full Name	Abbreviation
Window Fan	WinFan
Natural Ventilation	N-Vent
Natural Ventilation (B)	N-Vent B
General Ventilation (60/40)	G-Vent (60/40)
General Ventilation (B) (60/40)	G-Vent B (60/40)
Local Ventilation (80/20)	L-Vent (80/20)
Partial Vapor Barrier Room (95/5)	PVR (95/5)
Full Vapor Barrier Room	FVR

Table B-3. Potential Cancer Risk at Residential and Off-site Worker Receptors from Generic Dry Cleaners Using Secondary Control and Anaheim Meteorological Data[1, 2]

Scenario	CANCER RISK (chances per million)															
	Distance (meters)[3]															
	20	**30**	**40**	**50**	**60**	**70**	**80**	**90**	**100**	**120**	**140**	**160**	**180**	**200**	**300**	**400**
Resident – High-End Breathing Rate																
WinFan	205	117	73	51	39	30	24	20	17	12	10	8	6	5	2	2
N-Vent	160	98	67	46	37	29	24	20	16	12	9	7	6	5	2	2
N-Vent B[4]	112	70	51	38	30	24	20	17	14	11	8	7	6	5	2	1
G-Vent (60/40)[5]	164	100	65	47	36	29	23	19	16	12	9	7	6	5	2	2
G-Vent B[4] (60/40)[5]	108	73	51	38	29	23	19	16	14	10	8	7	6	5	2	1
L-Vent (80/20)[5,6]	61	44	33	27	22	18	15	13	11	8	7	5	4	4	2	1
PVR (95/5)[5,6]	72	54	41	32	26	21	17	14	12	9	7	6	5	4	2	1
FVR[6]	68	52	40	32	25	20	17	14	12	9	7	6	5	4	2	1
Resident – 80th Percentile Breathing Rate																
WinFan	158	90	56	39	30	23	18	15	13	9	7	6	5	4	2	1
N-Vent	123	75	51	35	28	22	18	15	12	9	7	6	5	4	2	1
N-Vent B[4]	86	54	39	29	23	18	15	13	11	8	6	5	4	4	2	1
G-Vent (60/40)[5]	126	77	50	36	28	22	18	15	12	9	7	6	5	4	2	1
G-Vent B[4] (60/40)[5]	83	56	39	29	22	18	15	12	11	8	6	5	4	4	2	1
L-Vent (80/20)[5,6]	47	34	25	21	17	14	12	10	8	6	5	4	3	3	2	1
PVR (95/5)[5,6]	55	41	32	25	20	16	13	11	9	7	5	4	4	3	2	1
FVR[6]	52	40	31	25	19	15	13	11	9	7	5	4	4	3	2	1
Resident – Average Breathing Rate																
WinFan	141	81	50	35	27	21	17	14	12	8	7	5	4	3	2	1
N-Vent	110	68	46	32	26	20	17	14	11	8	6	5	4	3	2	1
N-Vent B[4]	77	48	35	26	21	17	14	12	10	8	6	5	4	3	2	1
G-Vent (60/40)[5]	113	69	45	32	25	20	16	13	11	8	6	5	4	3	2	1
G-Vent B[4] (60/40)[5]	74	50	35	26	20	16	13	11	10	7	6	5	4	3	2	1
L-Vent (80/20)[5,6]	42	30	23	19	15	12	10	9	8	6	4	4	3	3	1	1
PVR (95/5)[5,6]	50	37	28	22	18	14	12	10	8	6	5	4	3	3	2	1
FVR[6]	47	36	28	22	17	14	12	10	8	6	5	4	3	3	2	1
Off-site Worker																
WinFan	131	75	46	32	25	19	15	13	11	8	6	5	4	3	2	1
N-Vent	102	62	43	29	24	18	15	13	10	8	6	5	4	3	2	1
N-Vent B[4]	71	45	32	24	19	15	13	11	9	7	5	4	4	3	1	1
G-Vent (60/40)[5]	104	64	41	30	23	18	15	12	10	8	6	5	4	3	2	1
G-Vent B[4] (60/40)[5]	69	46	32	24	18	15	12	10	9	6	5	4	4	3	1	1
L-Vent (80/20)[5,6]	39	28	21	17	14	11	10	8	7	5	4	3	3	2	1	1
PVR (95/5)[5,6]	46	34	26	20	17	13	11	9	8	6	4	4	3	3	1	1
FVR[6]	43	33	25	20	16	13	11	9	8	6	4	4	3	3	1	1

1. All results are rounded and represent generic dry cleaning scenarios using secondary control technology. Results are presented using a Perc unit emission rate of 1,350 pounds per year (100 gallons /yr).
2. Results are for the inhalation pathway. Residents assume a 70-year exposure duration and use the high-end, 80th percentile, and average point estimate breathing rates. The worker breathing rate and a 40-year exposure duration is used for the off-site worker receptor. This risk assessment is based on the methodology outlined in The Air Toxics Hot Spots Program Guidance Manual for Preparation of Health Risk Assessments, August 2003 (OEHHA Guidelines) (OEHHA, 2003a) and the ARB's Recommended Interim Risk Management Policy for Inhalation-Based Residential Cancer Risk (ARB, 2003a).
3. Distances are presented from the building edge.
4. Building is approximately 2,500 square feet. Other scenarios use a building approximately 1,100 square feet.
5. Values identified within the parenthesis identify the ratio that emissions are modeled from a point and volume source.
6. Denotes an enhanced ventilation scenario. Results corresponding to these scenarios are anticipated after implementation of the proposed ATCM.

Table B-4. Potential Cancer Risk at Residential and Off-site Worker Receptors from Generic Dry Cleaners Using Secondary Control and Fresno Meteorological Data[1, 2]

Scenario	CANCER RISK (chances per million)															
	Distance (meters)[3]															
	20	**30**	**40**	**50**	**60**	**70**	**80**	**90**	**100**	**120**	**140**	**160**	**180**	**200**	**300**	**400**
Resident – High-End Breathing Rate																
WinFan	103	63	41	29	21	16	13	10	9	6	5	4	3	2	1	<1
N-Vent	90	54	36	26	19	15	12	10	8	6	5	4	3	2	1	<1
N-Vent B[4]	62	40	28	21	16	13	10	9	7	5	4	3	3	2	1	<1
G-Vent (60/40)[5]	83	53	36	26	20	15	12	10	8	6	5	4	3	2	1	<1
G-Vent B[4] (60/40)[5]	53	37	28	21	16	13	11	9	7	6	4	3	3	2	1	<1
L-Vent (80/20)[5,6]	48	34	25	19	15	12	10	8	7	5	4	3	3	2	1	<1
PVR (95/5)[5,6]	50	37	27	21	16	13	11	9	8	6	4	3	3	2	1	<1
FVR[6]	48	36	27	20	16	13	10	9	7	6	4	3	3	2	1	<1
Resident – 80th Percentile Breathing Rate																
WinFan	79	48	32	22	16	12	10	8	7	5	4	3	2	2	1	<1
N-Vent	69	41	28	20	15	12	9	8	6	5	4	3	2	2	1	<1
N-Vent B[4]	48	31	22	16	12	10	8	7	6	4	3	3	2	2	1	<1
G-Vent (60/40)[5]	64	41	28	20	15	12	9	8	6	5	4	3	2	2	1	<1
G-Vent B[4] (60/40)[5]	41	28	22	16	12	10	8	7	6	4	3	3	2	2	1	<1
L-Vent (80/20)[5,6]	37	26	19	15	12	9	8	6	5	4	3	3	2	2	1	<1
PVR (95/5)[5,6]	38	28	21	16	12	10	8	7	6	4	3	3	2	2	1	<1
FVR[6]	37	28	21	15	12	10	8	7	6	4	3	3	2	2	1	<1
Resident – Average Breathing Rate																
WinFan	71	43	28	20	14	11	9	7	6	4	3	3	2	2	1	<1
N-Vent	62	37	25	18	13	10	8	7	6	4	3	2	2	2	1	<1
N-Vent B[4]	43	28	19	14	11	9	7	6	5	4	3	2	2	2	1	<1
G-Vent (60/40)[5]	57	37	25	18	14	10	8	7	6	4	3	2	2	2	1	<1
G-Vent B[4] (60/40)[5]	37	26	19	14	11	9	8	6	5	4	3	2	2	2	1	<1
L-Vent (80/20)[5,6]	33	23	17	13	10	8	7	6	5	4	3	2	2	2	1	<1
PVR (95/5)[5,6]	34	26	19	14	11	9	8	6	5	4	3	2	2	2	1	<1
FVR[6]	33	25	19	14	11	9	7	6	5	4	3	2	2	2	1	<1
Off-site Worker																
WinFan	66	40	26	18	13	10	8	6	6	4	3	2	2	2	1	<1
N-Vent	57	34	23	17	12	10	8	6	5	4	3	2	2	2	1	<1
N-Vent B[4]	39	25	18	13	10	8	6	5	5	3	3	2	2	1	1	<1
G-Vent (60/40)[5]	53	34	23	17	13	10	8	6	5	4	3	2	2	2	1	<1
G-Vent B[4] (60/40)[5]	34	24	18	13	10	8	7	6	5	4	3	2	2	1	1	<1
L-Vent (80/20)[5,6]	31	22	16	12	10	8	6	5	5	3	3	2	2	1	1	<1
PVR (95/5)[5,6]	32	24	17	13	10	8	7	6	5	4	3	2	2	1	1	<1
FVR[6]	31	23	17	13	10	8	6	6	5	4	3	2	2	1	1	<1

1. All results are rounded and represent generic dry cleaning scenarios using secondary control technology. Results are presented using a Perc unit emission rate of 1,350 pounds per year (100 gallons /yr).
2. Results are for the inhalation pathway. Residents assume a 70-year exposure duration and use the high-end, 80th percentile, and average point estimate breathing rates. The worker breathing rate and a 40-year exposure duration is used for the off-site worker receptor. Results are for the inhalation pathway. Residents assume a 70-year exposure duration and use the high-end, 80th percentile, and average point estimate breathing rates. The worker breathing rate and a 40-year exposure duration is used for the off-site worker receptor. This risk assessment is based on the methodology outlined in The Air Toxics Hot Spots Program Guidance Manual for Preparation of Health Risk Assessments, August 2003 (OEHHA Guidelines) (OEHHA, 2003a) and the ARB's Recommended Interim Risk Management Policy for Inhalation-Based Residential Cancer Risk (ARB, 2003a).
3. Distances are presented from the building edge.
4. Building is approximately 2,500 square feet. Other scenarios use a building approximately 1,100 square feet.
5. Values identified within the parenthesis identify the ratio that emissions are modeled from a point and volume source.
6. Denotes an enhanced ventilation scenario. Results corresponding to these scenarios are anticipated after implementation of the proposed ATCM.

Table B-5. Potential Cancer Risk at Residential and Off-site Worker Receptors from Generic Dry Cleaners Using Secondary Control and Oakland (port) Meteorological Data[1, 2]

Scenario	CANCER RISK (chances per million)															
	Distance (meters)[3]															
	20	**30**	**40**	**50**	**60**	**70**	**80**	**90**	**100**	**120**	**140**	**160**	**180**	**200**	**300**	**400**
Resident – High-End Breathing Rate																
WinFan	109	67	43	30	22	17	14	11	9	7	5	4	3	3	1	<1
N-Vent	92	55	37	26	20	15	12	10	8	6	5	4	3	2	1	<1
N-Vent B[4]	64	41	29	21	16	13	11	9	7	6	4	3	3	2	1	<1
G-Vent (60/40)[5]	87	56	38	27	20	16	13	10	9	6	5	4	3	2	1	<1
G-Vent B[4] (60/40)[5]	55	39	29	22	17	14	11	9	8	6	4	4	3	2	1	<1
L-Vent (80/20)[5,6]	50	37	27	21	16	13	11	9	8	6	4	4	3	2	1	<1
PVR (95/5)[5,6]	53	40	29	22	17	14	11	10	8	6	5	4	3	3	1	<1
FVR[6]	51	39	29	22	17	14	11	9	8	6	5	4	3	3	1	<1
Resident – 80th Percentile Breathing Rate																
WinFan	84	51	33	23	17	13	11	8	7	5	4	3	2	2	1	<1
N-Vent	71	42	28	20	15	12	9	8	6	5	4	3	2	2	1	<1
N-Vent B[4]	49	32	22	16	12	10	8	7	6	4	3	3	2	2	1	<1
G-Vent (60/40)[5]	67	43	29	21	15	12	10	8	7	5	4	3	2	2	1	<1
G-Vent B[4] (60/40)[5]	42	30	22	17	13	11	8	7	6	4	3	3	2	2	1	<1
L-Vent (80/20)[5,6]	38	28	21	16	12	10	8	7	6	4	3	3	2	2	1	<1
PVR (95/5)[5,6]	41	31	22	17	13	11	8	7	6	5	4	3	2	2	1	<1
FVR[6]	39	30	22	17	13	11	8	7	6	5	4	3	2	2	1	<1
Resident – Average Breathing Rate																
WinFan	75	46	30	21	15	12	10	8	6	5	3	3	2	2	1	<1
N-Vent	63	38	26	18	14	10	8	7	6	4	3	3	2	2	1	<1
N-Vent B[4]	44	28	20	14	11	9	8	6	5	4	3	2	2	2	1	<1
G-Vent (60/40)[5]	60	39	26	19	14	11	9	7	6	4	3	3	2	2	1	<1
G-Vent B[4] (60/40)[5]	38	27	20	15	12	10	8	6	5	4	3	2	2	2	1	<1
L-Vent (80/20)[5,6]	34	26	19	14	11	9	8	6	5	4	3	2	2	2	1	<1
PVR (95/5)[5,6]	37	28	20	15	12	10	8	7	6	4	3	3	2	2	1	<1
FVR[6]	35	27	20	15	12	10	8	6	6	4	3	2	2	2	1	<1
Off-site Worker																
WinFan	69	43	27	19	14	11	9	7	6	4	3	2	2	2	1	<1
N-Vent	59	35	24	17	13	10	8	6	5	4	3	2	2	2	1	<1
N-Vent B[4]	41	26	18	13	10	8	7	6	5	4	3	2	2	1	1	<1
G-Vent (60/40)[5]	55	36	24	17	13	10	8	6	6	4	3	2	2	2	1	<1
G-Vent B[4] (60/40)[5]	35	25	18	14	11	9	7	6	5	4	3	2	2	2	1	<1
L-Vent (80/20)[5,6]	32	24	17	13	10	8	7	6	5	4	3	2	2	2	1	<1
PVR (95/5)[5,6]	34	25	18	14	11	9	7	6	5	4	3	2	2	2	1	<1
FVR[6]	32	25	18	14	11	9	7	6	5	4	3	2	2	2	1	<1

1. All results are rounded and represent generic dry cleaning scenarios using secondary control technology. Results are presented using a Perc unit emission rate of 1,350 pounds per year (100 gallons /yr).
2. Results are for the inhalation pathway. Residents assume a 70-year exposure duration and use the high-end, 80th percentile, and average point estimate breathing rates. The worker breathing rate and a 40-year exposure duration is used for the off-site worker receptor. Results are for the inhalation pathway. Residents assume a 70-year exposure duration and use the high-end, 80th percentile, and average point estimate breathing rates. The worker breathing rate and a 40-year exposure duration is used for the off-site worker receptor. This risk assessment is based on the methodology outlined in The Air Toxics Hot Spots Program Guidance Manual for Preparation of Health Risk Assessments, August 2003 (OEHHA Guidelines) (OEHHA, 2003a) and the ARB's Recommended Interim Risk Management Policy for Inhalation-Based Residential Cancer Risk (ARB, 2003a).
3. Distances are presented from the building edge.
4. Building is approximately 2,500 square feet. Other scenarios use a building approximately 1,100 square feet.
5. Values identified within the parenthesis identify the ratio that emissions are modeled from a point and volume source.
6. Denotes an enhanced ventilation scenario. Results corresponding to these scenarios are anticipated after implementation of the proposed ATCM.

Table B-6. Potential Cancer Risk at Residential and Off-site Worker Receptors from Generic Dry Cleaners Using Secondary Control and San Diego (Miramar) Meteorological Data[1, 2]

Scenario	CANCER RISK (chances per million) Distance (meters)[3]*															
	20	30	40	50	60	70	80	90	100	120	140	160	180	200	300	400
Resident – High-End Breathing Rate																
WinFan	108	61	40	29	22	17	14	11	9	7	5	4	3	3	1	<1
N-Vent	85	52	36	26	20	16	13	11	9	7	5	4	3	3	1	<1
N-Vent B[4]	61	38	27	20	16	13	11	9	8	6	5	4	3	3	1	<1
G-Vent (60/40)[5]	85	51	35	26	20	16	13	11	9	7	5	4	3	3	1	<1
G-Vent B[4] (60/40)[5]	58	38	25	20	16	13	11	9	8	6	5	4	3	3	1	<1
L-Vent (80/20)[5,6]	47	32	23	17	14	11	9	7	6	5	4	3	3	2	1	<1
PVR (95/5)[5,6]	47	34	25	19	14	11	9	8	7	5	4	3	3	3	1	<1
FVR[6]	45	33	24	18	14	11	9	7	6	5	4	3	3	2	1	<1
Resident – 80^{th} Percentile Breathing Rate																
WinFan	83	47	31	22	17	13	11	8	7	5	4	3	3	2	1	<1
N-Vent	65	40	28	20	15	12	10	8	7	5	4	3	3	2	1	<1
N-Vent B[4]	47	29	21	15	12	10	8	7	6	4	3	3	2	2	1	<1
G-Vent (60/40)[5]	65	39	27	20	15	12	10	8	7	5	4	3	3	2	1	<1
G-Vent B[4] (60/40)[5]	45	29	19	15	12	10	8	7	6	4	4	3	2	2	1	<1
L-Vent (80/20)[5,6]	36	25	18	13	11	8	7	6	5	4	3	2	2	2	1	<1
PVR (95/5)[5,6]	36	26	19	15	11	8	7	6	5	4	3	3	2	2	1	<1
FVR[6]	35	25	18	14	11	8	7	6	5	4	3	3	2	2	1	<1
Resident – Average Breathing Rate																
WinFan	74	42	28	20	15	12	10	8	6	5	4	3	2	2	1	<1
N-Vent	59	36	25	18	14	11	9	8	6	5	4	3	2	2	1	<1
N-Vent B[4]	42	26	19	14	11	9	8	6	5	4	3	3	2	2	1	<1
G-Vent (60/40)[5]	59	35	24	18	14	11	9	8	6	5	4	3	2	2	1	<1
G-Vent B[4] (60/40)[5]	40	26	17	14	11	9	8	6	5	4	3	3	2	2	1	<1
L-Vent (80/20)[5,6]	32	22	16	12	10	8	6	5	4	3	3	2	2	2	1	<1
PVR (95/5)[5,6]	32	23	17	13	10	8	6	5	4	4	3	2	2	2	1	<1
FVR[6]	31	23	17	12	10	8	6	5	4	3	3	2	2	2	1	<1
Off-site Worker																
WinFan	69	39	25	18	14	11	9	7	6	4	3	3	2	2	1	<1
N-Vent	54	33	23	17	13	10	8	7	6	4	3	3	2	2	1	<1
N-Vent B[4]	39	24	17	13	10	8	7	6	5	4	3	2	2	2	1	<1
G-Vent (60/40)[5]	54	32	22	17	13	10	8	7	6	4	3	3	2	2	1	<1
G-Vent B[4] (60/40)[5]	37	24	16	13	10	8	7	6	5	4	3	2	2	2	1	<1
L-Vent (80/20)[5,6]	30	20	15	11	9	7	6	5	4	3	2	2	2	1	1	<1
PVR (95/5)[5,6]	30	22	16	12	9	7	6	5	4	3	3	2	2	2	1	<1
FVR[6]	29	21	15	11	9	7	6	5	4	3	3	2	2	2	1	<1

1. All results are rounded and represent generic dry cleaning scenarios using secondary control technology. Results are presented using a Perc unit emission rate of 1,350 pounds per year (100 gallons /yr).
2. Results are for the inhalation pathway. Residents assume a 70-year exposure duration and use the high-end, 80^{th} percentile, and average point estimate breathing rates. The worker breathing rate and a 40-year exposure duration is used for the off-site worker receptor. Results are for the inhalation pathway. Residents assume a 70-year exposure duration and use the high-end, 80^{th} percentile, and average point estimate breathing rates. The worker breathing rate and a 40-year exposure duration is used for the off-site worker receptor. This risk assessment is based on the methodology outlined in The Air Toxics Hot Spots Program Guidance Manual for Preparation of Health Risk Assessments, August 2003 (OEHHA Guidelines) (OEHHA, 2003a) and the ARB's Recommended Interim Risk Management Policy for Inhalation-Based Residential Cancer Risk (ARB, 2003a).
3. Distances are presented from the building edge.
4. Building is approximately 2,500 square feet. Other scenarios use a building approximately 1,100 square feet.
5. Values identified within the parenthesis identify the ratio that emissions are modeled from a point and volume source.
6. Denotes an enhanced ventilation scenario. Results corresponding to these scenarios are anticipated after implementation of the proposed ATCM.

The chronic hazard indices are less than 0.4 at all receptor locations under the high-end (90th percentile) emissions scenario and less than 0.2 at all receptor locations under the average emissions scenario. The acute hazard indices are less than 0.2 at all receptor locations for dry cleaners with secondary control. Generally, hazard indices less than 1.0 are not considered to be a concern to public health.

REFERENCES FOR APPENDIX B

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